

OLIGEMBIA VETUSTA, A NEW FOSSIL TERATEMBIID (EMBIOPTERA) FROM DOMINICAN AMBER

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Abstract.—A new species, *Oligembia vetusta*, is described on the basis of a male in lower Tertiary amber from the Dominican Republic. The new species is the first fossil representative of the family TeratembIIDae. The systematic position of the new species is discussed, as is the paraphyletic nature of the genus *Oligembia*. A cladogram of teratembIID genera is presented.

There are few records of fossil Embioptera. Until now, only two species from amber have been described: *Electroembia antiqua* (Pictet, 1854) from Baltic amber and *Burmitembia venosa* Cockerell, 1919 from Burmese amber.

David Grimaldi, of the American Museum of Natural History, has kindly provided for study two male Embioptera in Dominican amber. The amber is from the Lower Tertiary (ca. 25–30 my). A review of the evidence for this dating is provided by Grimaldi (1991).

In one of those two specimens, the abdominal terminalia (which provide most of the characters used at lower taxonomic levels) are unfortunately not preserved. The size, type of mandibles, wing venation, and shape and chaetotaxy of the hind basitarsus, suggest that this specimen belongs in the family AnisembIIDae.

The other specimen is well preserved and belongs to the family TeratembIIDae. This family is composed of three American genera (*Diradius* Friederichs, 1934 and *Oligembia* Davis, 1939 with species from Texas to Argentina including Caribbean islands, and *Teratembia* Krauss, 1911 with species from Argentina, Paraguay, and Brasil) and one African genus (*Paroligembia* Ross, 1952, with a single species from Angola). The new species has a character combination that clearly excludes it from *Teratembia*, *Diradius*, or *Paroligembia*, and would place it in the genus *Oligembia*. However, all the characters previously proposed as diagnostic for that genus (Ross, 1984) are actually found in only some of its species or are synapomorphies for TeratembIIDae in general (Szumik, 1991).

An analysis of the higher classification of the order is presently being completed (Szumik, ms.). In that study, 36 characters are used in a cladistic analysis of 41 species (representing 32 genera from 8 families); *Teratembia* (the only genus of TeratembIIDae analyzed there) appeared within the family Oligotomidae (Fig. 1).

Oligotomidae has three genera: *Oligotoma* Westwood, 1837 from the Indian region, *Aposthonia* Krauss, 1911 from Australia and tropical Asia, Indonesia, and Melanesia (Ross 1963:135), and *Haploembia* Verhoeff, 1904 from the Mediterranean and Black Sea.

In the analysis of Szumik (ms.; relevant results summarized in Fig. 1) the group *Teratembia* + Oligotomidae was supported by the posterior half of the right tenth hemitergite separated from the rest of the tergite.

Table 1. Data matrix.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Outgroup	0	0	0	1	0	—	0	0	0	—	—	—	0
<i>A. glauerti</i>	1	1	1	1	0	1	1	0	2	—	—	1	0
<i>A. gurneyi</i>	1	1	1	1	0	0	1	1	2	—	—	1	0
<i>H. solieri</i>	0	0	—	1	0	0	0	0	0	—	—	0	0
<i>O. nigra</i>	1	1	1	0	1	0	1	0	2	0	0	1	0
<i>O. saundersii</i>	1	1	1	0	1	0	1	1	2	0	0	1	0
<i>D. erba</i>	1	1	0	1	1	2	1	0	1	1	4	0	1
<i>D. plaumanni</i>	1	1	0	1	1	2	1	0	1	1	4	0	1
<i>O. hubbardi</i>	1	1	0	1	1	1	1	0	1	0	4	0	1
<i>O. melanura</i>	1	1	0	1	1	1	1	0	1	0	2	0	1
<i>O. mini</i>	1	1	0	1	1	1	1	0	2	0	3	0	1
<i>O. peruviana</i>	1	1	0	0	1	1	1	0	0	0	0	0	1
<i>P. angolica</i>	1	1	0	0	1	2	1	0	1	0	1	0	1
<i>T. geniculata</i>	1	1	0	1	1	2	1	0	2	0	4	0	1
<i>O. vetusta</i>	1	1	0	0	1	1	1	0	0	0	3	0	1

Teratembia + *Oligotoma* + *Aposthonia* share the absence of a middle bladder on the hind basitarsus (char. 0), the hind basitarsus narrow and with few hairs (char. 1), and the process of the right hemitergite of tenth abdominal tergite with a small thorn on the dorsal face (char. 6). The presence of a basal process on the left cercus appeared as an autapomorphy of *Teratembia* (as seen below, this is actually a synapomorphy of Teratembidae, and its presence in some *Oligotoma* is a parallelism).

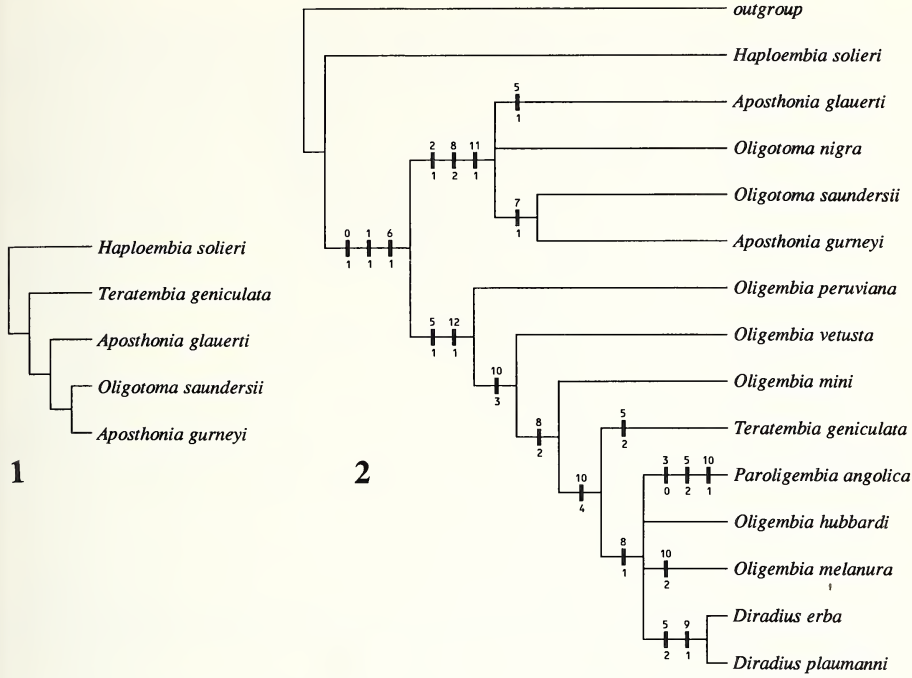
In that larger study (Szumik, ms.) the only representative of the Teratembidae used is the genus *Teratembia*. That analysis, therefore, does not provide any information on the monophyly of the Teratembidae or their interrelationships. A more detailed analysis (including all the described genera of Teratembidae) is made here, to give some insight on the relationships between the teratembiid genera and to place the new species.

METHODS

Fourteen species were used in this analysis (see data matrix in Table 1). Five of them (Fig. 1) had been used in the larger analysis (Szumik, ms.), to which *Oligembia vetusta* and eight other described species of Oligotomidae and Teratembidae were added. *Paroligembia angolica* Ross, 1952 was the only species for which I did not see specimens; this species was scored on basis of the original description. The outgroup has the character states of the common ancestor of Oligotomidae + *Teratembia* in the most parsimonious tree found in Szumik (ms.).

A method for weighting characters according to their homoplasy is used here. The method is based on searching "heaviest trees," with character weights defined as a concave function of homoplasy (Goloboff, 1993a).

Hennig86 (Farris, 1988) was used to find the shortest tree(s) for the equally weighted data, Pee-Wee (Goloboff, 1993b) used to weight the characters and to find the heaviest tree(s), and Clados (Nixon, 1992) used to produce tree diagrams.



Figs. 1, 2. 1. Relationship of Oligotomidae and Teratembiidae proposed in Szumik (ms.). 2. Strict consensus of two trees produced by data matrix in Table 1.

Parallelisms observed in taxa outside the ingroup were considered when calculating the weight of the characters analyzed here (Pee-Wee calculates character weights as $30/(3 + R + ES)$, where R is the variation outside the ingroup and ES is the extra steps on the tree).

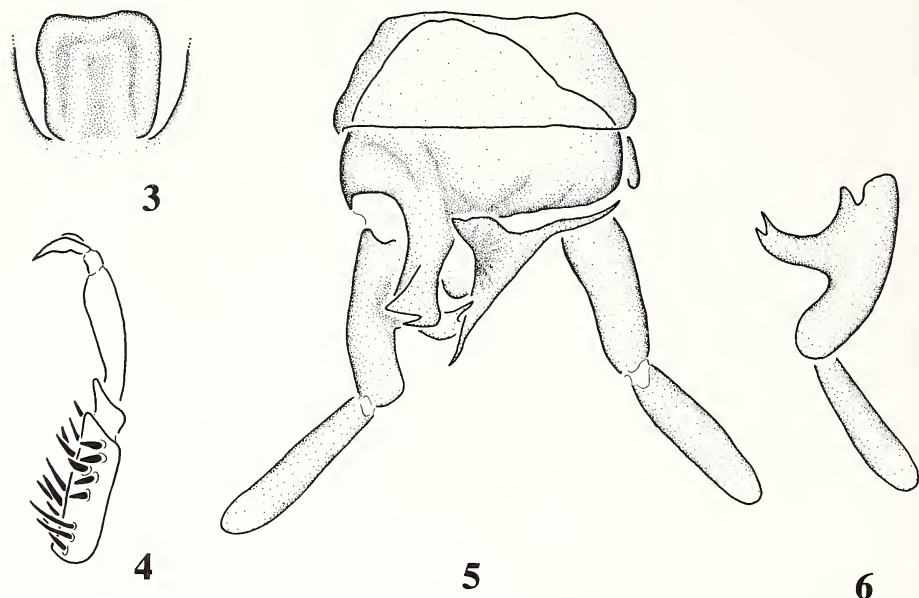
In this analysis the ambiguous optimizations were not considered as support for any clade. The consensus tree (Fig. 2) does not show one optimization, but instead those synapomorphies common to all possible dichotomous parsimonious resolutions (Goloboff, 1993b).

Abbreviations for male terminalia follow Szumik (1991). Measurements are given in millimeters. Ocular ratio is defined in Szumik (1991).

CHARACTERS

Eight of the 36 characters from the larger analysis were used (the other 28 characters were not used here, because they are not informative at the present taxonomic level). Five characters were added.

- 0) Middle bladder of the hind basitarsus (Davis, 1938): 0, present; 1, absent.
- 1) Form and chaetotaxy of the hind basitarsus: 0, broad with many hairs on ventral area; 1, narrow with few hairs on ventral area.
- 2) Wings, Ma vein (Davis, 1938): 0, forked; 1, unforked.



Figs. 3-6. *Oligembia vetusta*. 3. Submentum. 4. Right hind basitarsus, anterior view. 5. Terminalia, dorsal view. 6. Process of the left cercus, ventral view.

3) Apical process of the LC1: 0, absent; 1, present.

4) Basal process of the LC1: 0, absent; 1, present.

5) Process of the 10L: 0, leaf-like with a longitudinal ridge; 1, subdivided in subequal inner and outer margins; 2, same as state 1 but inner and outer margins differentiated in hook and leaf-like portions.

6) Process of the 10R: 0, sharp hook; 1, leaf-like with a small thorn on the dorsal surface.

Table 2. Characters: extra steps, variation observed outside the group, fit.

Char.	Ex. steps	O.v.	Fit
0	—	6	3.3
1	—	5	3.7
2	—	1	7.5
3	4	1	3.7
4	2	1	5.0
5	2	8	2.3
6	—	5	3.7
7	—	—	10.0
8	1	—	7.5
9	—	—	10.0
10	—	—	10.0
11	—	—	10.0
12	—	—	10.0

- 7) Lpp: 0, normal; 1, hook-like.
- 8) Separation between MS and 10R: 0, without lines of fusion; 1, with lines of fusion; 2, separated by a membranous area.
- 9) LCBP: 0, simple; 1, complex.
- 10) Apex of the LCBP: 0, blunt; 1, one spine (not sclerotized and not articulated with base); 2, one spine (sclerotized and articulated with base); 3, two spines (same as state 1); 4, two spines (same as state 2).
- 11) Hp: 0, plate-like form; 1, tubular form.
- 12) Relation between MS and 10L: 0, without lines of fusion; 1, with lines of fusion.

RESULTS AND DISCUSSION

Pee-Wee found 2 trees (the strict consensus of which is shown in Fig. 2) with total fit 86.7, 29 steps long. These trees are 1 step longer than the 236 trees found by Hennig86. The strict consensus of those 236 trees and those found by Pee-Wee would have in common the groups: Oligotomidae (without *Haploembia*) + Teratembidae, Oligotomidae (without *Haploembia*), Teratembidae, and *Diradius erba* Szumik, 1991 + *D. plaumanni* (Ross, 1944) (Fig. 2).

The monophyly of Teratembidae is supported by the 10LP with inner and outer margins subequal (char. 5) and fusion lines between 10L and MS (char. 12). The group formed by *O. vetusta* and the rest of the teratembids (Fig. 2) is supported by the apex of the LCBP with 2 points (char. 10). Although this character is the only one which supports that group, it does not have any homoplasy (Table 2).

It seems clear from this analysis that *Oligembia* is not a monophyletic group, and that the species included in the genus share no more than symplesiomorphies. If a new genus was created for the new fossil species, a new genus would be necessary for each species in the pectinate part of the cladogram (Fig. 2). For the moment, and given the preliminary nature of this analysis, *O. vetusta* is provisionally incorporated into the genus *Oligembia*, considering this as a parayphyletic group. I propose that those oligembids having a membranous area or lines of fusion between 10R and MS, and apex with two points (with an articulate base), and the genera *Teratembia*, *Diradius*, and *Paroligembia*, form a monophyletic group, and that their sister group is *O. vetusta*.

***Oligembia vetusta*, new species**

Figs. 3–7

Diagnosis. *O. vetusta* can be distinguished from other *Oligembia* by the following combination of characters: LCBP finishing in two short points no more sclerotized than the rest of the process, LC1 curved, submentum strongly depressed around the margins, and no lines of fusion between 10RP and MS.

Type. Holotype male from Dominican amber in The American Museum of Natural History, New York.

Etymology. The specific name is a Spanish adjective for something old and obsolete.

Male holotype. As in Figure 7. Total length: 5.15. Head: rectangular, width/length, 0.72. Ocular ratio: 0.66. Mandibles: teratembid type. Submentum as in Figure 3. Wing lengths: anterior, 3.43; posterior, 2.80. Wing venation: R1 and Cu conspicuous,

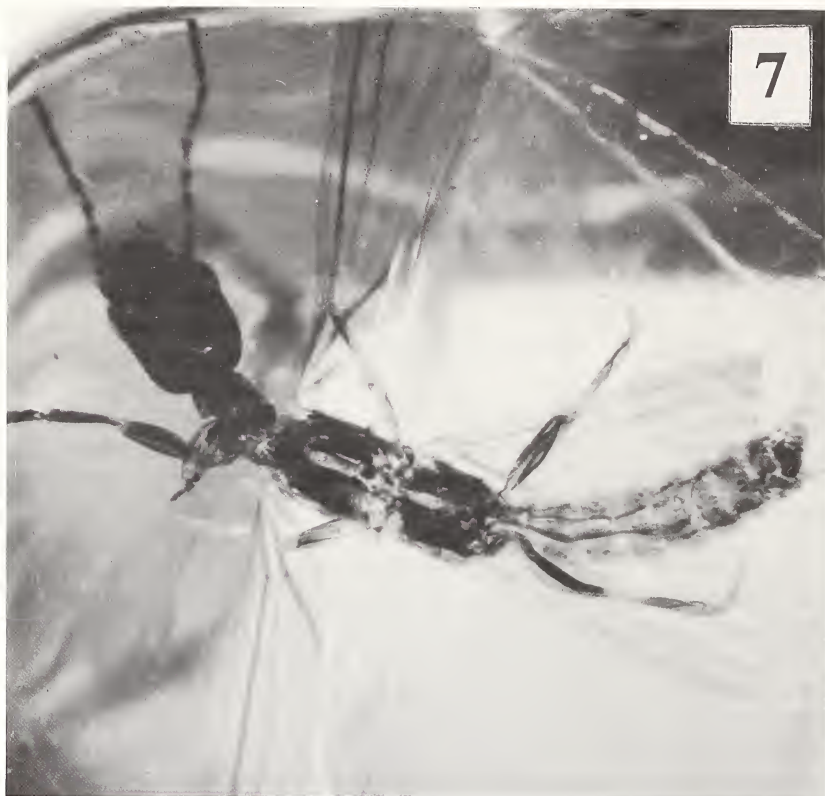


Fig. 7. *Oligembia vetusta*, holotype male (photograph by D. A. Grimaldi).

Rs + Ma and Rs more or less conspicuous, the rest marked by rows of macrotrichia. Cross veins: 2 to 3 between C and R1, 2 to 3 between R1 and Rs. Rs + Ma and Mp originating on a cross vein between R1 and Cu. Hind basitarsus, length: 0.15, width/length: 0.33; setae as in Fig. 4. Terminalia: as in Fig. 5. 10R fused to the MS, no lines of fusion between them. Some lines of fusion (but shallow) between 10L and MS. 10R strongly depressed on the posterior margin. LCBP with two sharp, short points in the apex (Fig. 6), no more sclerotized than the rest of the process. Ventral terminalia not observable (H, Hp and LPPT obscured by a bubble).

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